

Phase change materials for super resolution microscopy

S. Petit, D. Molenda, K. Kurihara, T. Shima, T. Nakano and J. Tominaga
Center for Applied Near-field Optics Research (CAN-FOR),
National Institute of Advanced Industrial Science and Technology (AIST)
Tsukuba Central 4, 1-1-1 Higashi, Tsukuba 305-8562, Japan
E-mail: stephane.petit@aist.go.jp

Abstract

Phase change materials are widely used in optical data storage techniques. The first generation of Super-Resolution Near-field Structure discs (Super-RENS) lies on a phase change layer used as a mask in order to reduce the effective size of the laser spot that reads the pits in the optical disc. Besides this applied technique, some methods such as aperture type Scanning Near-field Optical Microscopy have been proposed to overcome the diffraction limit and image small objects. We propose here to transfer the Super-RENS technique to the optical microscopy in order to retrieve objects beyond the diffraction limit.

A phase change layer is deposited on the sample studied with an inverted laser-scanning optical microscope (Olympus IX71) and an oil immersion objective lens (60X; NA=1.25). When the laser power is increased above a threshold power, the phase change layer acts as a window and reduces the effective size of the laser spot which is then able to resolve objects beyond the diffraction limit. This technique can resolve objects smaller than 200 nm by using a HeNe laser beam at 632.8 nm, scanning the sample surface. Beside the fact that this super resolution microscope is a simple technique, it is possible to image the small objects within a few seconds for an area as wide as 16 μm x 16 μm .